A New Species of Autolytus (Polychaeta: Syllidae) Commensal on a California Hydrocoral

John D. Wright and Keith H. Woodwick

Abstract.—A new species of polychaete of the genus *Autolytus* is described from the hydrocoral *Allopora californica*. The atokous stage lives on the surface of the hydrocoral within a blister of host origin. This type of host association was not previously known in the genus *Autolytus*.

Division of Epidemiology, School of Public Health, University of California, Los Angeles, California 90024 and Department of Biology, California State University, Fresno, California 93740.

A new species of *Autolytus*, a syllid polychaete of the subfamily Autolytinae, was found in the hydrocoral *Allopora californica* Verrill. Only two other species of *Autolytus*, *A*. ?*cornutus* Agassiz and *A*. *varius* Treadwell, have been reported from California (Hartman, 1968). Hartman (1955) also reported an *Autolytus* sp.

The subfamily Autolytinae has been extensively studied by two workers: Imajima (1964, with O. Hartman, 1966) wrote two descriptive papers on Japanese autolytins; Gidholm (1963, 1965, 1967a, 1967b, and 1969) published on the taxonomy and biology of Scandanavian forms.

Materials and Methods

Specimens utilized in this study occurred in separate collections of hydrocoral from Farnsworth Bank off Santa Catalina Island and Gull Island off Santa Cruz Island, California. The Farnsworth Bank specimens were taken at a depth of over 18.4 m while the Gull Island material was from about 6.1 m.

All of the material examined for the descriptive portion of the present study was collected by the senior author at Gull Island and fixed in formaldehyde at the collecting site. Following fixation the material was transferred to 70% ethanol for examination and storage. Portions of hydrocoral with polychaete blisters were decalcified in dilute HNO_3, washed, post-fixed in osmium tetroxide, and then dehydrated by an ethanol series followed by propylene oxide. The material was then embedded in Spurr's epoxy-resin (Spurr, 1969). Sections (0.75 μm) were cut with glass knives on an LKB Ultratome III, transferred in a drop of water to a microscope slide, dried down on a hotplate, and hot-stained with Paragon epoxy tissue stain (Spurlock et al. 1966). A few thin sections were also cut from the same specimens, section-stained with uranyl acetate followed by lead citrate and examined with a Philips EM 300. Scanning electron microscopy was performed on specimens which had been dehydrated in ethanol, critical-point dried, shadowed with carbon followed by gold or gold-paladium, and examined with a Cambridge Stereoscan SEM.

Illustrations of setae are composites based on both phase-contrast and scanning electron microscopy. The trepan illustration is a composite from a through-focus series of light micrographs of an excised pharynx.

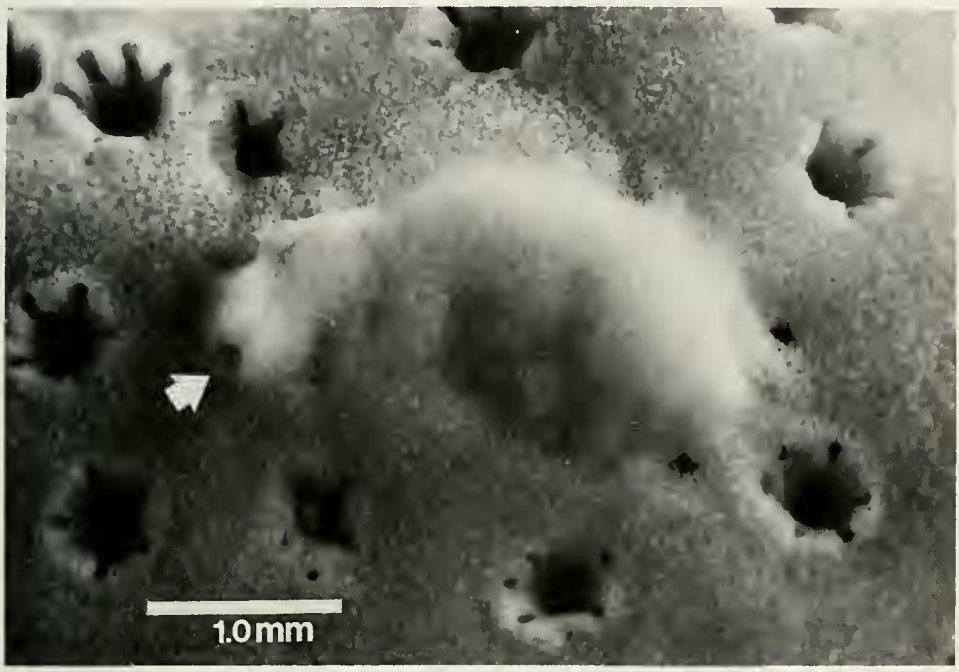

Fig. 1. Photomicrograph of the vermiform mound or blister of *Autolytus penetrans* on *Allopora californica*. Arrow indicates entrance to blister.

Autolytus (Regulatus) penetrans, n. sp.

Type material.—Holotype (Poly 1176), complete atokous specimen along with coral sample from which it came; Paratype (Poly 1241), male epitoke described below. Both deposited in the collections of the Allan Hancock Foundation, University of Southern California, Los Angeles.

Diagnosis.—*Autolytus penetrans* can be separated from other species by the following combination of characteristics: (1) trepan with nine regular teeth, (2) S-shaped pharynx, (3) generally smaller size (less than 3.0 mm), and (4) association with *Allopora californica*.

Description of atokous stage.—Atokous stage forming a blister on surface of hydrocoral; blister vermiform in exterior appearance with average length 3.0–4.0 mm, width 0.8 mm (Fig. 1); blister provided with pore or opening through which (it is assumed) worm feeds and releases stolonic buds (Fig. 1, arrow). Prostomium broader than long, possessing two pairs of red lenticular eyes, trapezoidally arranged, with anterior pair slightly larger and farther apart; size and length of antennae, tentacles, and cirri variable due to preservation (but some generalizations are appropriate): median antenna, located just forward of and between anterior pair of eyes, longer than lateral antennae; lateral antennae arising from anterior margin of prostomium; antennae irregularly annulate (Fig. 2).

Two pairs of anteriorly directed, tentacular cirri arising from anterolateral margin of peristomium; dorsal tentacular cirrus slightly shorter than lateral antennae, not annulate; ventral tentacular cirrus as long as or longer than median antenna, irregularly annulate (Fig. 2); ventral segmental cirri absent; dorsal segmental cirri

Fig. 2. Scanning electron micrograph of anterior view of *Autolytus penetrans*.

short, generally not articulated, and showing tendency for reduction in size in posterior region of body; nuchal epaulettes not observed in preserved material (even after otherwise obscurring antennae or cirri had been removed); S-shaped pharynx leading to proventriculus of about four segments long, normally located within setigers 4–8 (in one specimen the proventriculus had about 26 rows of muscle bands, and a cross section of another had 25 radially arranged muscle bundles); pharynx terminating distally in a ring of five rather blunt papillae (in several preserved specimens the trepan was located at the posterior edge of the first setiger, but in others at the posterior margin of the peristomium or within the second setiger); dorsal epidermal gland of Gidholm's (1967a) sphaerulate A-type observed in peristomium.

Each setigerous segment with pair of dorsoventrally aligned setal fasicles consisting of 4–9 setae per side; single dorsalmost bayonet-type setae (of the thick type following terminology of Gidholm, 1967a) often present in each bundle (Fig. 3B); remainder of setae compound bidentate (Fig. 3D).

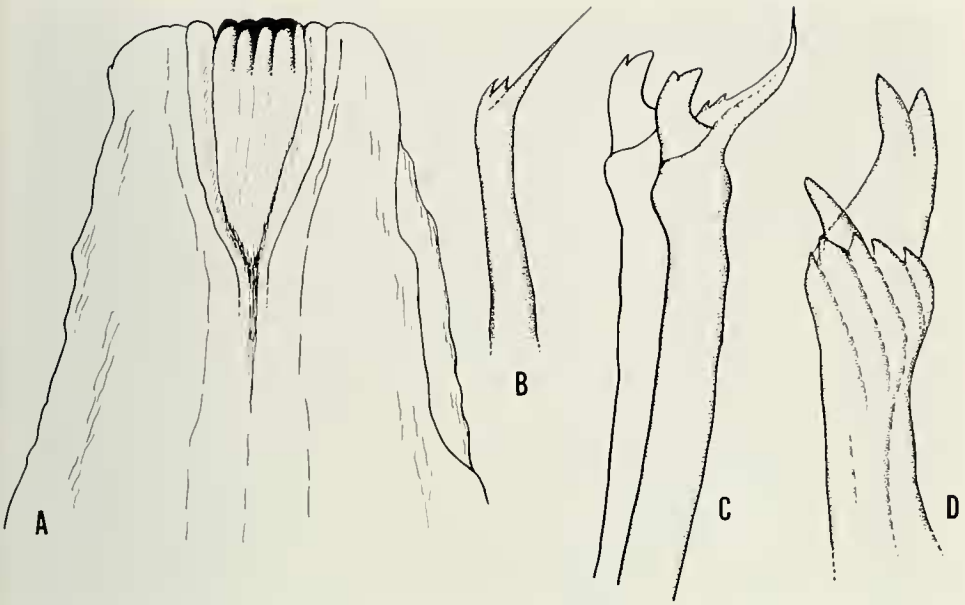

Fig. 3. *Autolytus penetrans*: A. Trepan, B. Bayonet seta, C. Progenitor seta, D. Compound bidentate seta.

A complete non-stolonic atokous specimen measured 2.5 mm long by about 0.5 mm wide and consisted of 38 setigerous followed by 5 non-setigerous segments. The color of the specimens preserved in formaldehyde and stored in 70% alcohol is white, but the eyes retain a reddish pigmentation.

Description of epitokous stage.—Several apparently immature epitokes of *Autolytus penetrans* were found within coral blisters. One of these possessed swimming setae. Except for enlargement of the anterior pair of eyes, the presence of swimming setae, no obvious proventriculus, and sperm duct glands in segments two through five, they differed little in general appearance from the atokous form. A more mature male or "Polybostrichus" stolon obtained from a blister which also contained an atokous individual is described as follows: specimen about 2.0 mm in length, consisting of prostomium, peristomium, and 36 setigerous segments, plus terminal non-setigerous segment; prostomium with 2 bifid antennae arising from anterior ventrolateral angles and 2 enlarged anterior eyes; other dorsal prostomial appendages broken off or absent; tentacular cirri of peristomium of undetermined length; setiger 1 with fasicle of compound setae including bayonet seta similar to atokous variety; setigers 2–5 with same setal arrangement but also containing sperm duct glands; setigers 7–25 with larger but normally-shaped atokous seta on neuropodia and long swimming setae on enlarged notopodia; setigers 26–35 distinctly smaller, bearing only normal atokous fasicles; worm terminating in a nonsetigerous segment with two blunt ovoid appendages.

Discussion

Autolytus sp. (Hartman, 1955) was dredged from fine mud material at a depth of 732 m and from mud and sand at 31 m in the San Pedro Basin, California. *Autolytus cornutus* and *A. varius* were collected intertidally as epitokes. Pettibone

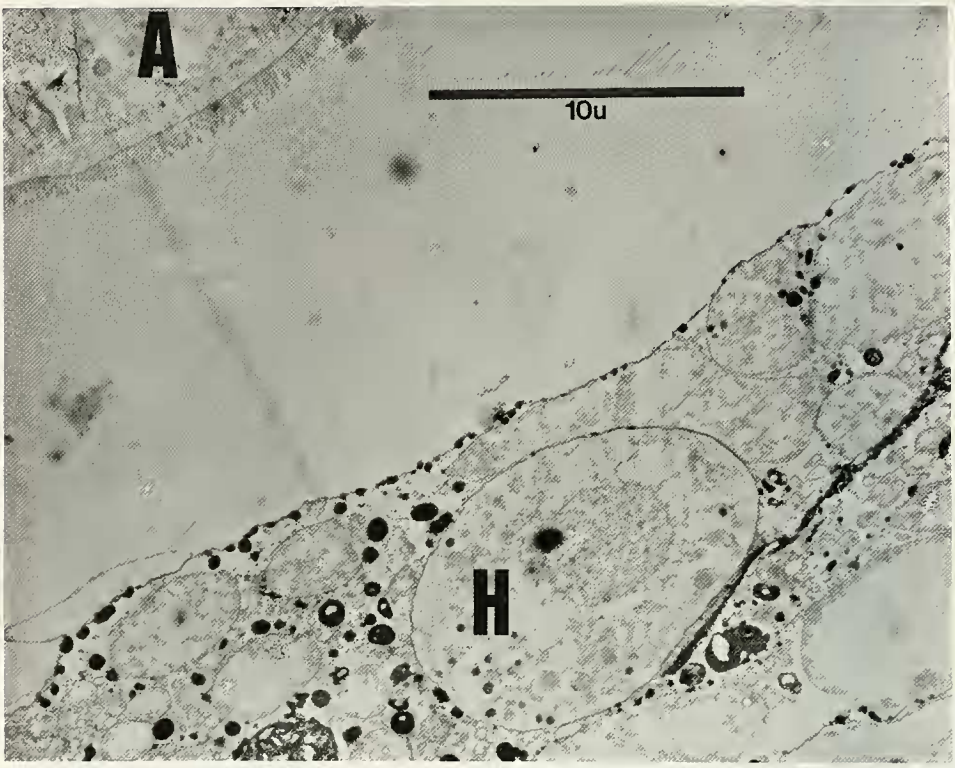

Fig. 4. Transmission electronmicrograph of the inner lining of the coral blister demonstrating its cellular make-up. A = *Autolytus penetrans*, H = hydrocoral.

(1963) reported that *Autolytus cornutus* constructs cylindrical tubes attached to algae and branches of hydroids, but she mentioned no species of *Autolytus* associated with hydrocorals. Hartman (1954) reported *Autolytus* sp. from the lagoon side of Rigili Island, Eniwetok Atoll from blocks on the reef flat close to the beach rock belt. The type of association with living coral, if any, was not mentioned.

The present species forms a blister on the hydrocoral. Although this habitat is unusual for *Autolytus* forms, blister forming polychaetes are not unique. Some polydorids and other polychaetes actually drill the shell. Blake and Evans (1973) reported on the burrowing activities on polydorid worms (Spionidae) and have described what they call polydorid "mud-blisters" on the surface of mollusks to which the mollusk reacts by secreting over the mud a roof of conchiolin and later a layer of nacreous material. The worms live within the mud-filled blister which communicates with the surface. The burrow eventually becomes U-shaped or modified U-shaped. Blake and Evans (1973) also stated that the method of burrow formation is independent of setal structure or position in *Polydora*. They suggested that chemical methods are most likely involved. While they mentioned the boring or blistering activities of *Polydora* and related forms into corals and hydrocorals, they also stated that there has been no research on the biology of coral infesting polydorids.

Ostarello (1973), in her study of the natural history of the hydrocoral *Allopora californica*, listed three obligate commensals including the following: *Balanus*

nefrens Zullo, a barnacle; *Polydora alloporis* Light, a spionid polychaete; and *Pedicularia californica* Newcomb, an ovulid snail. The first two commensals were also found in material collected for the present study. The minute size of the blister of *Autolytus penetrans* and of the worm itself has probably led to this commensal form going unnoticed until this time.

The worm apparently penetrates the surface of the hydrocoral resulting in a hyperplasia of cellular and calcareous material to produce the characteristic vermiform mound. An electron micrograph (Fig. 4) reveals the cellular makeup of the blister lining in spite of the formaldehyde fixation and acid decalcification. Light microscopy reveals that the mound is also lined by a layer of mucus, presumably the worms, but there is no evidence of a mucus tube such as described by Pettibone (1963) for *A. cornutus*. The blister may be located almost anywhere on the living hydrocoral with no specific association with the coral polyps. Occasionally a blister is encountered with the lumen oriented directly perpendicular to the surface of the hydrocoral. It could not be determined if this was the result of expanding the depression left by a polyp or entirely the result of the worm's activities.

Imajima (1966) made extensive use of trepan teeth in *Autolytus* taxonomy. Following the pattern suggested by Imajima (1966) *Autolytus penetrans* has been assigned to the subgenus *Regulatus* on the basis of a trepan of nine regular teeth (Fig. 3A). *Autolytus (R.) convolutus* is the only other species in which only nine regular teeth are known. *Autolytus penetrans* differs in pharyngeal configuration having an S-shaped pharynx in contrast to the irregularly coiled pharynx of *A. convolutus*.

Because of its repeated collection from the hydrocoral *Allopora californica* from more than one locale and in different years, it is suggested that *Autolytus penetrans* is a well established species in this one habitat in California waters.

One additional general note is suggested by the appearance of the main seta in Fig. 3C. This seta could serve as the progenitor of the bayonet seta by loss of the distal, bidentate compound portion and of the compound bidentate by erosion of the bayonet portion. It would be interesting to determine if this is the actual pattern in *Autolytus penetrans* and, if so, whether it is characteristic of other more inclusive taxonomic groups.

Acknowledgments

The authors wish to thank Mr. Lance Hollister of Reseda, California who collected the original material, and Dr. Kristian Fauchald, Allan Hancock Foundation, University of Southern California, Los Angeles who provided advice on preparation of this paper.

Literature Cited

Blake, J. A., and J. W. Evans. 1973. *Polydora* and related genera as borers in mollusk shells and other calcareous substrates. Veliger, 15:235–249.

Gidholm, L. 1963. The sexual organs in the budding form of *Autolytus* (Syllidae; Polychaeta). Zool. Bidr., Uppsala, 35:529–543.

———. 1965. On the morphology of the sexual stages, mating and egg-laying in *Autolytus* (Polychaeta). Zool. Bidr., Uppsala, 37:1–44.

———. 1967a. On epigamy in *Autolytus* (Polychaeta), and non-stolonic Sacconereis and Polybostrichus stages. Ark. Zool., 19:135–142.

———. 1967b. A revision of Autolytinae (Syllidae, Polychaeta) with special reference to Scandinavian species, and with notes on external and internal morphology, reproduction and ecology. Ark. Zool., 19:157–213.

———. 1969. The role of light in the swarming of the Polychaete *Autolytus*. Zool. Bidr., Uppsala, 38:129–135.

Hartman, O. 1954. Marine Annelids from the northern Marshall Islands. U.S. Geol. Surv. Prof. Pap., 260:619–644.

———. 1955. Quantative survey of the benthos of San Pedro Basin, Southern California, Part I, Preliminary results. Univ. California Press, Berkeley, 185 pp.

———. 1968. Atlas of the Errantiate Polychaetous Annelids from California. Allan Hancock Found., Univ. So. California, 828 pp.

Imajima, M. 1966. The Syllidae (Polychaetous annelids) from Japan. (II) Autolytinae. Publ. Seto Mar. Biol. Lab., 14:27–83.

Imajima, M., and O. Hartman. 1964. The Polychaetous annelids of Japan. Allan Hancock Found. Occas. Pap., 26:1–452.

Ostarello, G. L. 1973. Natural history of the hydrocoral *Allopora californica* Verrill (1866). Biol. Bull., Woods Hole, Mass., 145:548–564.

Pettibone, M. H. 1963. Marine polychaete worms of the New England region. Part I. U.S. Nat. Mus. Bull., 227:1–356.

Spurlock, B. O., M. S. Skinner, and A. A. Kattine. 1966. A simple rapid method for staining epoxy-embedded specimens for light microscopy with the polychromatic stain Paragon-1301. Am. J. Clin. Pathol., 44:252–257.

Spurr, A. R. 1969. A low-viscosity epoxy resin embedding medium for electron microscopy. J. Ultrastruct. Res., 26:31–43.

Accepted for publication May 2, 1977.